INTERNATIONAL

Designation: ~~D5787 – 95 (Reapproved 2009)~~ D5787 – 14

Standard Practice for Monitoring Well Protection[1]

This standard is issued under the fixed designation D5787; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

INTRODUCTION

This practice for monitoring well protection is provided to promote durable and reliable protection of installed monitoring wells against natural and man caused damage. The practices contained promote the development and planning of monitoring well protection during the design and installation stage.

1. ~~Scope~~ Scope*

1.1 This practice identifies design and construction considerations to be applied to monitoring wells for protection from ~~natural and man caused damage or~~damage and/or impacts.

1.2 The installation and development of a well is a costly and detailed activity with the goal of providing representative samples and data throughout the design life of the well. Damages to the well at the surface frequently result in loss of the well or changes in the data. This standard provides for access control so that tampering with the installation should be evident. The design and installation of appropriate surface protection will mitigate the likelihood of damage or loss.

1.3 This practice may be applied to other surface or subsurface monitoring device locations, such as piezometers, permeameters, temperature or moisture monitors, or seismic devices to provide protection.

1.4 *Units*—The values stated in ~~inch-pound~~ SI (inch-pound) units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 *This practice offers a set of instructions for performing one or more specific operations. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this practice may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.*

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

~~C150~~D653 ~~Specification for Portland Cement~~Terminology Relating to Soil, Rock, and Contained Fluids
~~C294 Descriptive Nomenclature for Constituents of Concrete Aggregates~~
~~D5092~~D5918 ~~Practice for Design and Installation of Groundwater Monitoring Wells~~Test Methods for Frost Heave and Thaw Weakening Susceptibility of Soils

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of common technical terms in this standard, refer to Terminology D653.

[1] This practice is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.21 on Groundwater and Vadose Zone Investigations.

Current edition approved ~~April 1, 2009~~Oct. 1, 2014. Published ~~April 2009~~October 2014. Originally approved in 1995. Last previous edition approved in 2000 as D5787 – 95 (2009). ~~(2000).~~ DOI: ~~10.1520/D5787-95R09.~~10.1520/D5787-14.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

***A Summary of Changes section appears at the end of this standard**

3.2 ~~Definitions:~~*Definitions of Terms Specific to This Standard:*

3.2.1 ~~*barrier*—~~*barrier, n—*any device that physically prevents access or damage to an area.

3.2.2 *barrier* ~~*markers*—~~*markers, n—*plastic, or metal posts, often in bright colors, placed around a monitoring well to aid in identifying or locating the well.

3.2.3 ~~*barrier*~~*bollards, posts*~~—~~*n—*steel pipe, typically from ~~4 to 12 inches~~10 to 30 cm (4 to 12 in.) in diameter and normally filled with concrete or grout that are placed around a well location to protect the well from physical damage, such as from vehicles.

~~3.1.4 *borehole*—a circular open or uncased subsurface hole created by drilling.~~

~~3.1.5 *casing*—pipe, finished in sections with either threaded connections or bevelled edges to be field welded, which is installed temporarily or permanently to counteract caving, to advance the borehole, or to isolate the zone being monitored, or a combination thereof.~~

~~3.1.6 *casing, protective*—a section of larger diameter pipe that is emplaced over the upper end of a smaller diameter monitoring well riser or casing to provide structural protection to the well and restrict unauthorized access into the well.~~

~~3.1.7 *riser*—the pipe extending from the well screen to or above the ground surface.~~

3.2.4 *sealed* ~~*cap*—~~*cap, n—*a ~~sealable riser~~ PVC, steel, or alloy pipe end cap, normally gasketed or sealed, that is designed to prevent water or other substances from entering into, or out of the well riser.

~~3.1.9 *vented cap*—a cap with a small hole that is installed on top of the riser.~~

4. Significance and Use

4.1 An adequately designed and installed surface protection system will mitigate the consequences of ~~naturally~~ natural damage (that is, freeze/thaw damage) in susceptible areas, or man caused damages (that is, from vehicles), which could otherwise occur and result in either changes to the data, or complete loss of the monitoring well.

4.2 The extent of application of this practice may depend upon the importance of the monitoring data, cost of monitoring well replacement, expected or design life of the monitoring well, the presence or absence of potential risks, and setting or location of the well.

4.3 Monitoring well surface protection should be a part of the well design process, and installation of the protective system should be completed at the time of monitoring well installation and development.

4.4 Information determined at the time of installation of the protective system will form a baseline for future monitoring well inspection and maintenance. Additionally, elements of the protection system will satisfy some regulatory requirements such as for protection of near surface groundwater and well identification.

5. Design Considerations

5.1 The design of a monitoring well protective system is like other design processes, where the input considerations are determined and the design output seeks to remedy or mitigate the negative possibilities, while taking advantage of the site characteristics.

5.2 The factors identified in this practice should be considered during the design of the monitoring well protective system. The final design should be included in the monitoring well design and installation documentation and be completed and verified during the final completion and development of the well.

5.3 In determining the level or degree of protection required, the costs and consequences, such as loss of data or replacement of the well, must be weighed against the probability of occurrence and the desired life of the well. For monitoring wells which will be used to obtain data over a short time period, the protection system may be minimal. For wells which are expected to be used for an indefinite period, are in a vulnerable location, and for which the costs of lost data could be high, the protective system should be extensive. Factors to consider and methods of mitigating them are presented in the following sections.

5.3.1 *Impact Damages*—Physical damages resulting from construction equipment, livestock, or vehicles striking the monitoring well casing frequently occur. Protective devices and approaches include:

5.3.1.1 Extra heavy protective casings with a reinforced concrete apron extending ~~several feet~~ 1 m or more (3 ft or more) around the casing may be an acceptable design in those areas where frost heave is not a problem. The principle behind this is to design the protective casing so that it will be able to withstand the impact of vehicles without damage to the riser within.

5.3.1.2 ~~Barrier Posts~~ Bollards placed in an array such that any anticipated vehicle can not pass between them to strike the protective casing. ~~Barrier posts~~ Bollards are typically filled with concrete and set in post holes ~~several feet deep~~ 1 m and greater (3 ft and greater) in depth, which are backfilled with concrete. ~~Barrier posts~~ Bollards typically extend from ~~3 to 5 feet~~1 to 1.5 m (3 to 5 ft) above the ground surface. ~~Barrier posts~~ Bollards are frequently used in and around industrial or high vehicle traffic areas. Costs for installation can be substantial however they provide a high degree of protection for exposed wells. Cost of removal at decommissioning can also be substantial.

NOTE 1—Cattle frequently rub against above ground completions leading to damage of unprotected casings. Concrete filled posts or driven T-posts, wrapped with barbed wire, are frequently used.

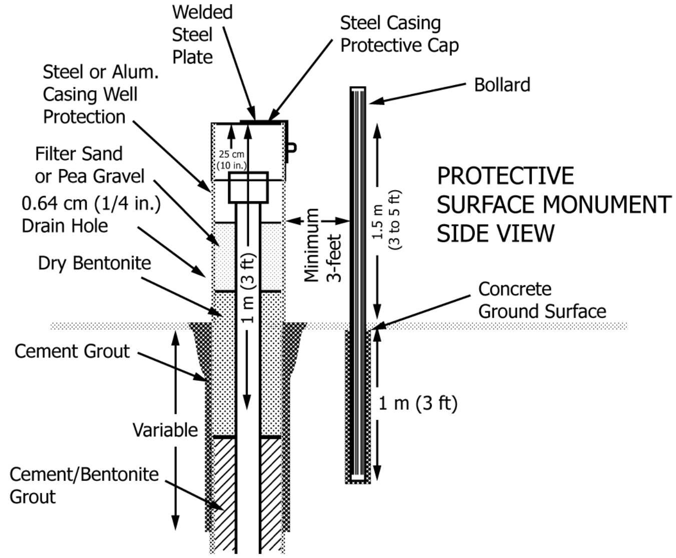

FIG. 1 Example of Protective Design

5.3.1.3 Barrier ~~Markers~~markers are relatively lightweight metal or often plastic posts which provide minimal impact resistance but which by their color, location, and height, warn individuals of the well presence. The use of barrier markers is effective in areas that are well protected from impact type damage by other features, such as surrounding structures or fences. They are relatively inexpensive to install.

~~5.3.1.4 *Signs*—An inexpensive means of identifying the presence of a monitoring well. Signs provide protection only by warning of the well presence. Signs may be required in some circumstances and appropriate in others. Wells known to contain hazardous, radioactive, or explosive compounds should be marked to warn sampling personnel of potential dangers. When a potential exists for water usage, signage indicating that the water is non-potable and is utilized strictly as a monitoring well, and not for any other purpose, may be appropriate. Disadvantages of signs are that they may be ignored, are often difficult to maintain, and may invite vandalism to the well.~~

5.3.1.4 Recessed or Subsurface casings may be used to mitigate impact damage by allowing the vehicles to pass over. Frequently used techniques include recessing the casing below ground level, using commercially available covers. These may take the form of valve pits or manholes, as examples. Advantages include both protecting the well while minimizing the interference to surface traffic, such as in parking lots or urban areas and screening the well from view. Using this technique, wells may be located in the most desired locations from a groundwater monitoring perspective. Disadvantages include the need to ~~assure~~ensure surface drainage does not enter the well riser, either by maintaining positive drainage or by using a sealed riser cap (or both). When the risk is from the influx of surface water, drains below the level of the riser should be installed. In extreme cases, such as in location with high groundwater levels or potential drainage from surrounding areas, automatic sump pumps may be required. Consideration should be given to the sampling personnel who will require adequate space to perform sampling, particularly in manhole situations. Additionally, personnel protection requirements from working in a confined space should be considered.

5.3.1.5 Fencing, such as commercial chainlink type fences may provide adequate protection in areas with light risk from vehicles, but where people or animals may interfere or affect the well. Advantages are relative minimal costs, ease of removal or opening. Disadvantages include maintenance, adequacy of protection from hard vehicle impacts, and visual and traffic interference.

5.3.2 *Vandalism*—Damage from vandals can take two forms, those which seek to damage or destroy the well itself, and those which intend to damage the data that the well may provide. Theft of sampling pumps, loss of access to the riser, plugging of the well with foreign debris, or injection of foreign materials or chemicals are potential results of vandalism.

5.3.2.1 Physical damage to the well can be minimized with many of the same techniques as used to protect the well from impact damages. Generally two techniques can be used to protect a well from physical damage, one, by hiding or camouflaging the well, the other by constructing the surface protection of the well with multiple physical barriers. Hiding or camouflaging the well utilizes the philosophy that what can't be found can't be damaged. Camouflage techniques include enclosing the well in manholes or sumps, planting shrubs or vegetation to shield the well from view, enclosing the well in another structure, such as inside a raised planter or a small shed. Color characteristics of the above ground can be used to disguise the well or to assist in making it blend into the surroundings. Costs for camouflage can vary widely, but are generally minimal when included with other protections. Disadvantages are that if found, the well is still susceptible to damage by vandals, that damage may be undetected, and that sampling personnel not familiar with the well may have difficulty locating it.

5.3.2.2 Protection from vandalism is generally achieved by constructing multiple physical barriers. The first barrier should always include a rugged protective casing with a locking cap or lid. The lock quality can vary from relatively inexpensive and easily broken types to more costly high security type locks. Locks used on wells are subject to weather, dirt and deterioration.